Internal resistance of a source of emf

Activity 240E: Experiment

Some of the energy given to charges by a cell (or other source of emf) is dissipated inside the cell itself, as the charges move through the cell. What is left is available as a potential difference (energy per unit charge) across a circuit connected to the cell. If the emf of the source is E, and its internal resistance is r , then when a current I flows the potential difference V is $V = E - I r$.

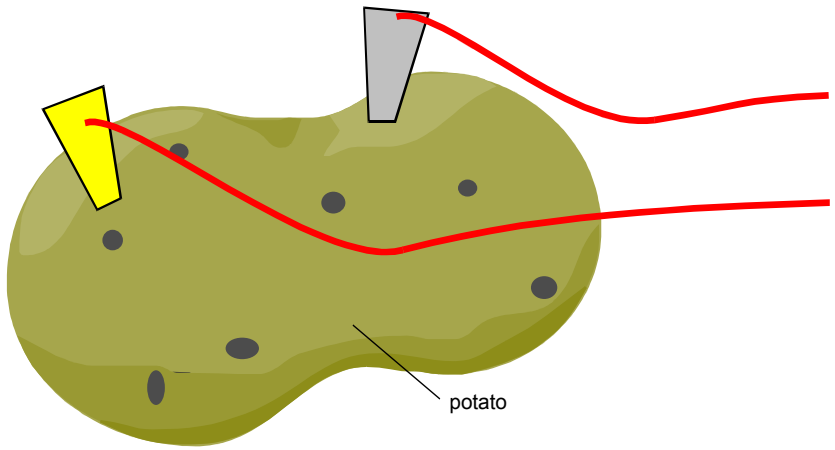
Collect this apparatus

- ✓ 2 digital multimeters
- ✓ potato
- ✓ 0.5 cm × 2 cm copper sheet, 0.5 cm × 2 cm zinc sheet
- ✓ 2 pairs of crocodile clips
- ✓ resistance substitution box
- ✓ 5 × 4 mm leads

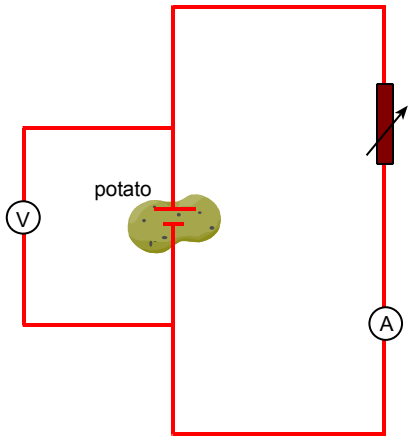
Getting, and making sense of, the data

First take a quick look. Then collect some detailed data that you can use to model the behaviour of the cell.

1. Assemble your cell. Use the copper and zinc sheets as electrodes, inserting one in each end of the potato. Use crocodile clips to make connections to the circuit.



2. Set up a circuit to measure the p.d. across the cell and the current drawn from the cell, initially with 4.7 kΩ as a load for the cell.



3. Alter the load resistance. Notice the changes to the current drawn and the p.d. supplied. Sketch a graph of p.d. / current to indicate the general trend.
4. Look back to the introduction above. Does your pattern seem likely to fit this description?
5. Now draw up a table of current and p.d. for a range of load resistances. You will need to be careful in selecting the values to use at both ends of the scale so that your measuring instruments can cope.
6. Plot a graph of V / I . Does it fit the pattern above?

Outcomes

1. You will recognise the drop of p.d. as a source supplies an increasing current.
2. You will be able to match this pattern to the description above.